

Channel Bandwidth: 10MHz

Channel 27710  
(2310.0MHz)

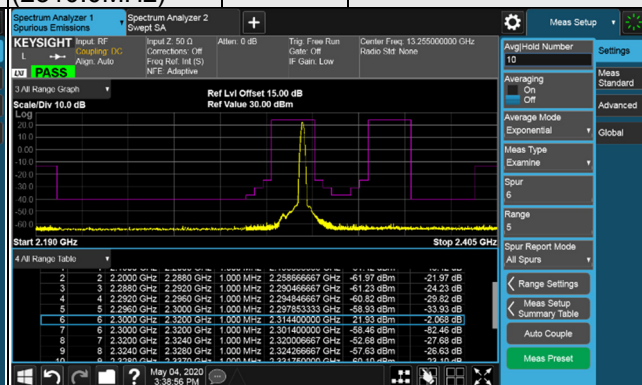
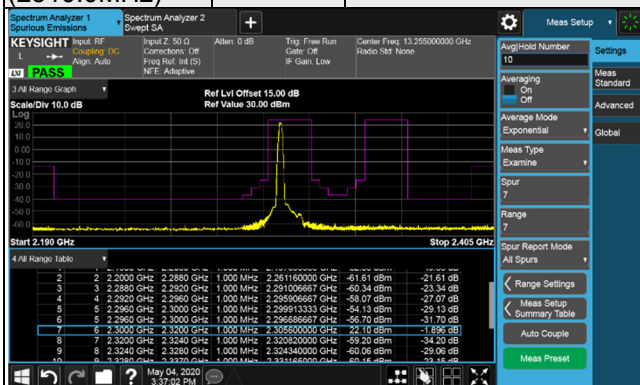
QPSK

1 RB / 0 RB Offset

Channel 27710  
(2310.0MHz)

QPSK

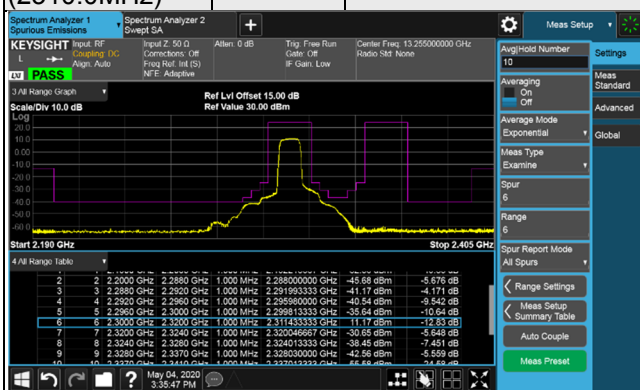
1 RB / 49 RB Offset



Channel 27710  
(2310.0MHz)

QPSK

50 RB / 0 RB Offset



LTE Band 71

Channel Bandwidth: 5MHz

Channel 133147  
(665.5MHz)

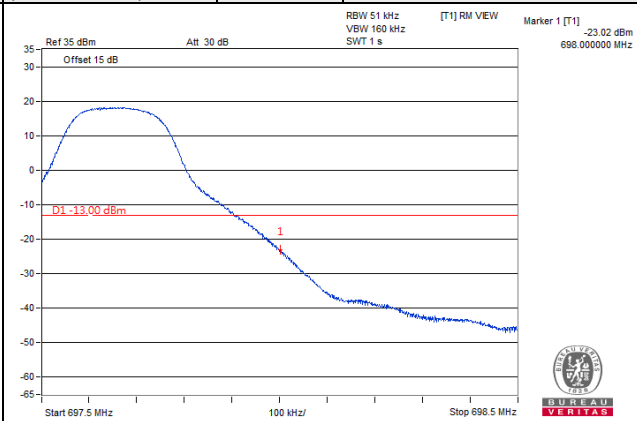
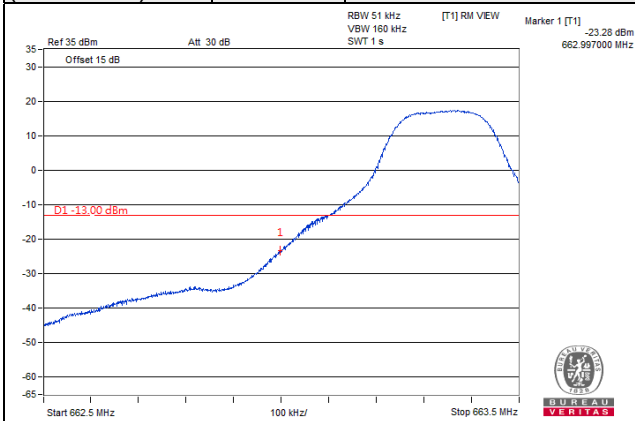
QPSK

1 RB / 0 RB Offset

Channel 133447  
(695.5MHz)

QPSK

1 RB / 24 RB Offset



Channel 133147  
(665.5MHz)

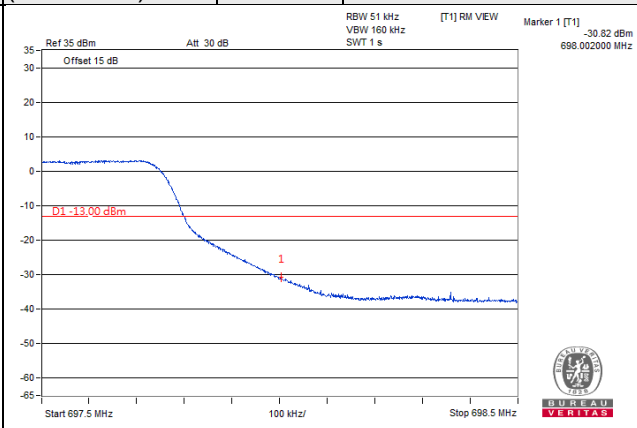
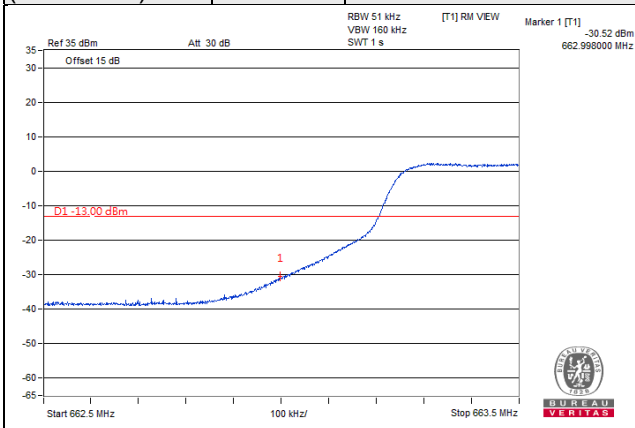
QPSK

25 RB / 0 RB Offset

Channel 133447  
(695.5MHz)

QPSK

25 RB / 0 RB Offset



Channel Bandwidth: 10MHz

Channel 133172  
(668.0MHz)

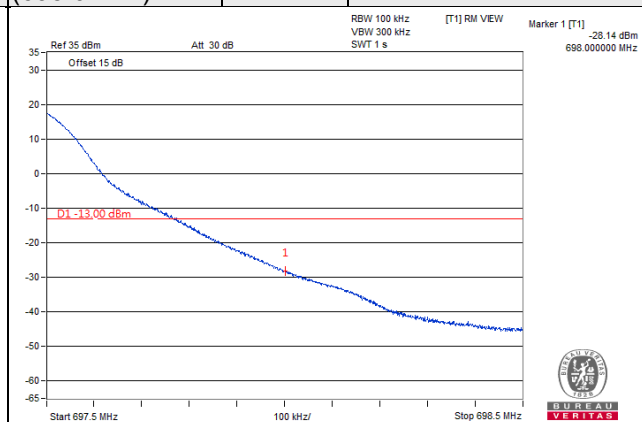
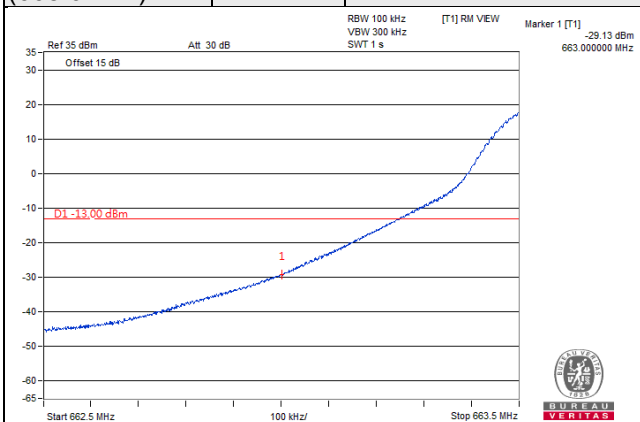
QPSK

1 RB / 0 RB Offset

Channel 133422  
(693.0MHz)

QPSK

1 RB / 49 RB Offset



Channel 133172  
(668.0MHz)

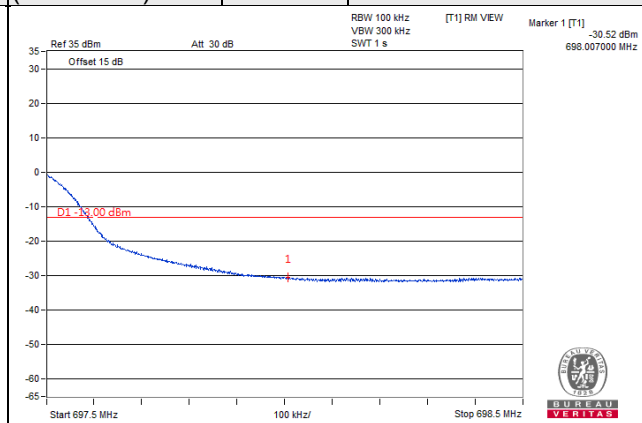
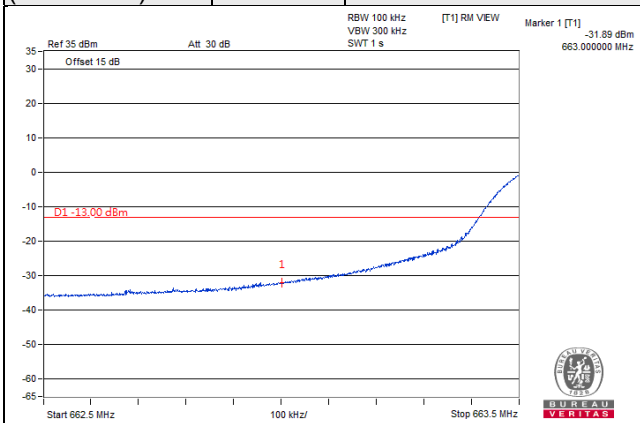
QPSK

50 RB / 0 RB Offset

Channel 133422  
(693.0MHz)

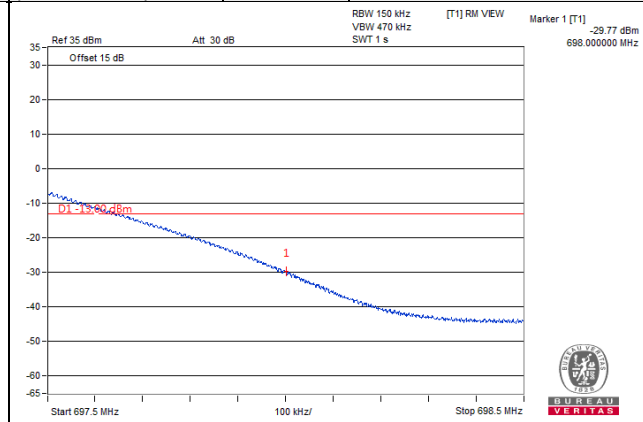
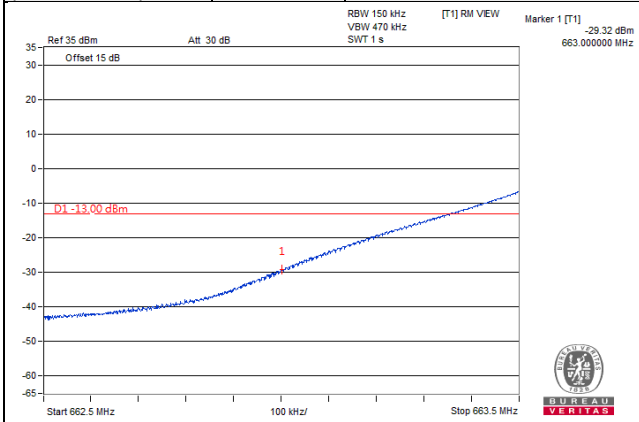
QPSK

50 RB / 0 RB Offset

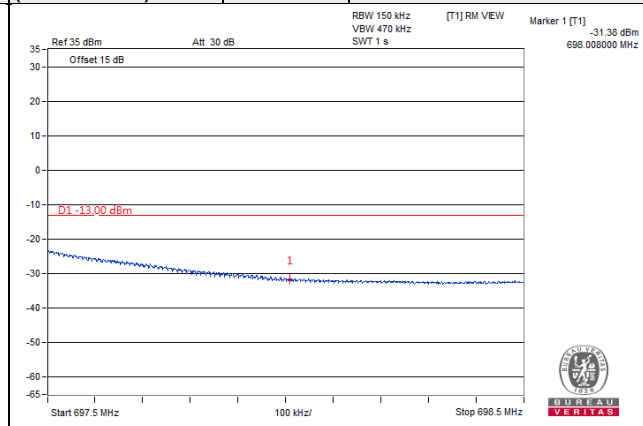
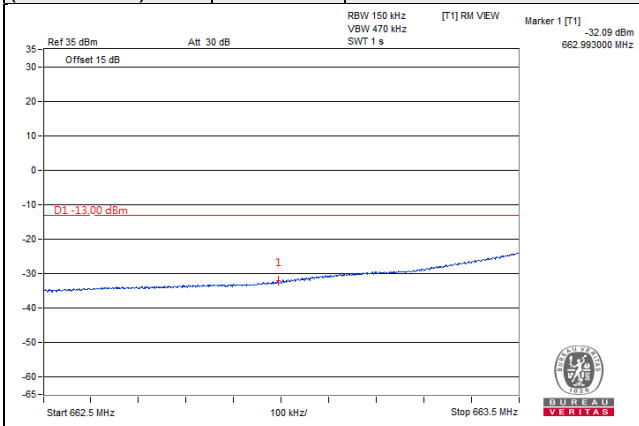


Channel Bandwidth: 15MHz

Channel 133197 (670.5MHz)	QPSK	1 RB / 0 RB Offset	Channel 133397 (690.5MHz)	QPSK	1 RB / 74 RB Offset
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Channel 133197 (670.5MHz)	QPSK	75 RB / 0 RB Offset	Channel 133397 (690.5MHz)	QPSK	75 RB / 0 RB Offset
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BUREAU VERITAS

Channel Bandwidth: 20MHz

Channel 133222  
(673.0MHz)

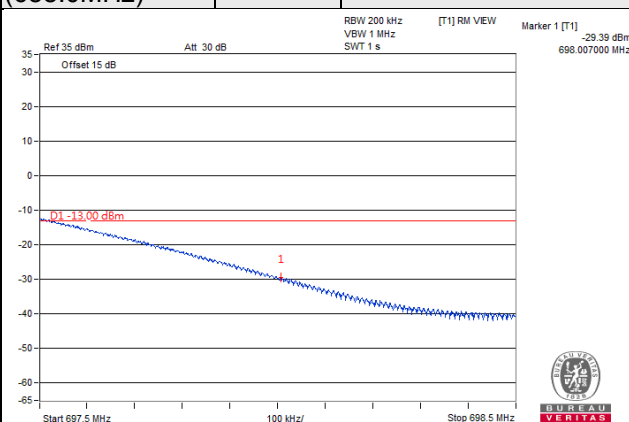
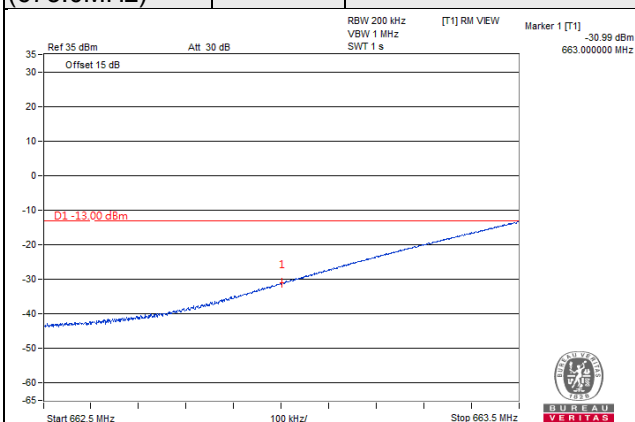
QPSK

1 RB / 0 RB Offset

Channel 133372  
(688.0MHz)

QPSK

1 RB / 99 RB Offset



Channel 133222  
(673.0MHz)

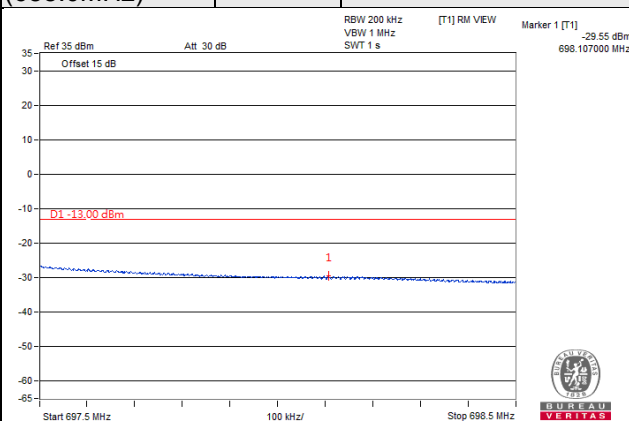
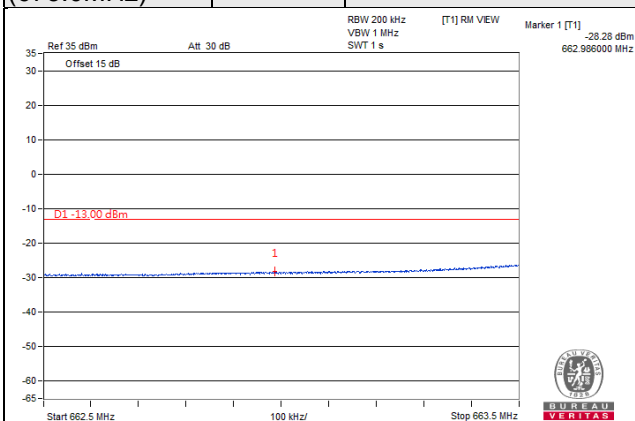
QPSK

100 RB / 0 RB Offset

Channel 133372  
(688.0MHz)

QPSK

100 RB / 0 RB Offset

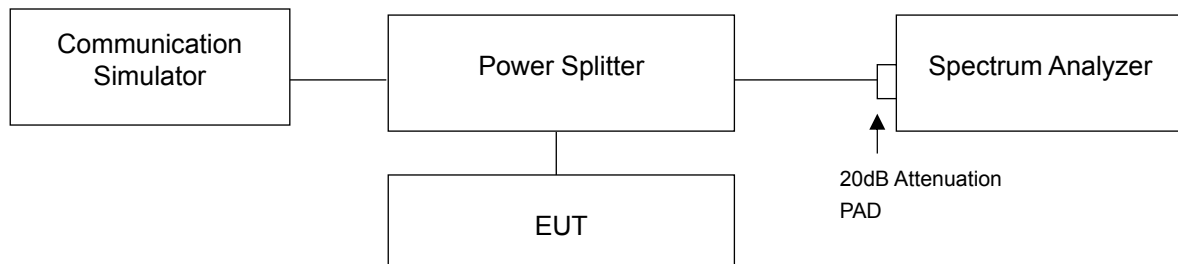


## 4.6 Peak to Average Ratio

### 4.6.1 Limits of Peak to Average Ratio Measurement

In measuring transmissions in this band using an average power technique, the peak to-average ratio (PAR) of the transmission may not exceed 13 dB

### 4.6.2 Test Setup



### 4.6.3 Test Procedures

- Set resolution/measurement bandwidth  $\geq$  signal's occupied bandwidth;
- Set the number of counts to a value that stabilizes the measured CCDF curve;
- Record the maximum PAPR level associated with a probability of 0.1%.

#### 4.6.4 Test Results

n66

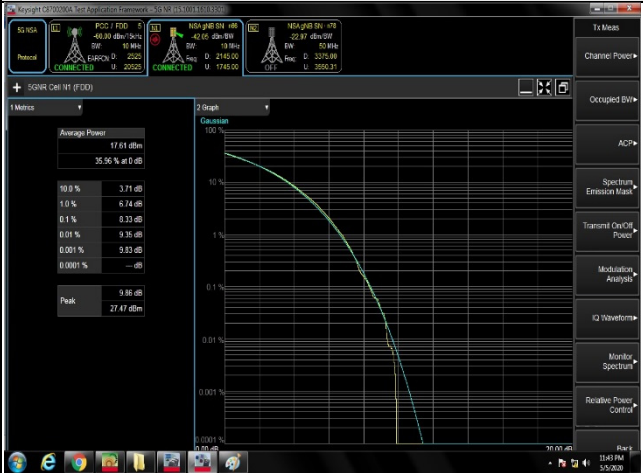
n66, Channel Bandwidth 5MHz						
Channel	Frequency (MHz)	Peak To Average Ratio (dB)				
		$\pi/2$ BPSK	QPSK	16QAM	64QAM	256QAM
342500	1712.5	4.26	3.67	4.76	4.88	8.42
349000	1745.0	4.09	3.64	5.16	5.29	8.35
355500	1777.5	4.03	3.67	5.28	5.45	8.22
n66, Channel Bandwidth 10MHz						
Channel	Frequency (MHz)	Peak To Average Ratio (dB)				
		$\pi/2$ BPSK	QPSK	16QAM	64QAM	256QAM
343000	1715.0	4.42	3.62	4.39	4.46	8.32
349000	1745.0	4.36	3.72	4.56	4.58	8.33
355000	1775.0	4.39	3.81	4.57	4.55	8.16
n66, Channel Bandwidth 15MHz						
Channel	Frequency (MHz)	Peak To Average Ratio (dB)				
		$\pi/2$ BPSK	QPSK	16QAM	64QAM	256QAM
343500	1717.5	4.57	3.62	4.47	4.52	8.47
349000	1745.0	4.65	3.59	4.38	4.45	8.42
354500	1772.5	4.99	3.59	4.49	4.56	8.19
n66, Channel Bandwidth 20MHz						
Channel	Frequency (MHz)	Peak To Average Ratio (dB)				
		$\pi/2$ BPSK	QPSK	16QAM	64QAM	256QAM
344000	1720.0	4.76	3.66	4.48	4.55	8.82
349000	1745.0	4.83	3.56	4.35	4.47	9.08
354000	1770.0	4.59	3.41	5.24	5.32	8.43

### Spectrum Plot of Worst Value

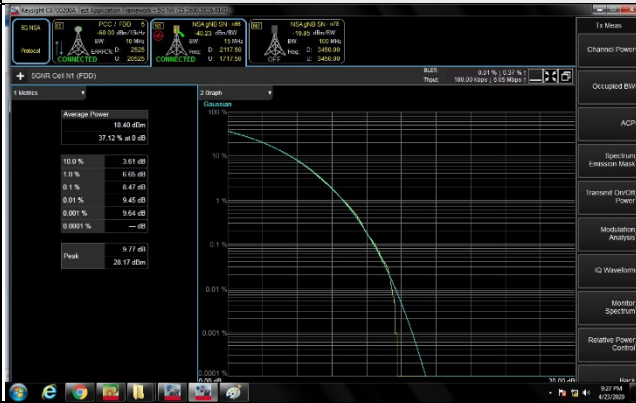
#### 5MHz / 256QAM



#### 10MHz / 256QAM



#### 15MHz / 256QAM



#### 20MHz / 256QAM



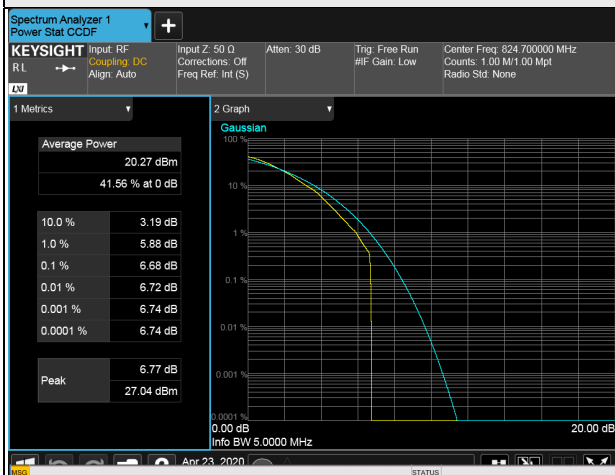


LTE Band 5

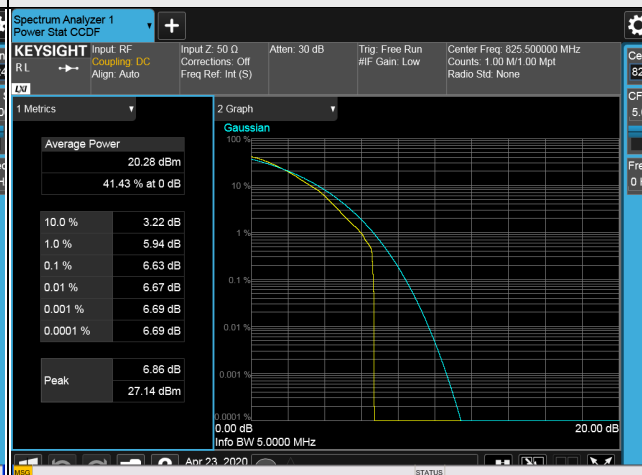
LTE Band 5, Channel Bandwidth 1.4MHz				
Channel	Frequency (MHz)	Peak To Average Ratio (dB)		
		QPSK	16QAM	64QAM
20407	824.7	4.15	4.84	6.68
20525	836.5	4.09	4.88	6.57
20643	848.3	3.49	4.23	6.20
LTE Band 5, Channel Bandwidth 3MHz				
Channel	Frequency (MHz)	Peak To Average Ratio (dB)		
		QPSK	16QAM	64QAM
20415	825.5	3.92	4.74	6.63
20525	836.5	3.85	4.69	6.50
20635	847.5	3.51	4.24	6.12
LTE Band 5, Channel Bandwidth 5MHz				
Channel	Frequency (MHz)	Peak To Average Ratio (dB)		
		QPSK	16QAM	64QAM
20425	826.5	3.83	5.36	6.38
20525	836.5	3.84	5.10	6.45
20625	846.5	3.70	4.97	6.15
LTE Band 5, Channel Bandwidth 10MHz				
Channel	Frequency (MHz)	Peak To Average Ratio (dB)		
		QPSK	16QAM	64QAM
20450	829.0	3.80	5.45	6.83
20525	836.5	3.88	5.57	6.74
20600	844.0	3.70	5.34	6.71

### Spectrum Plot of Worst Value

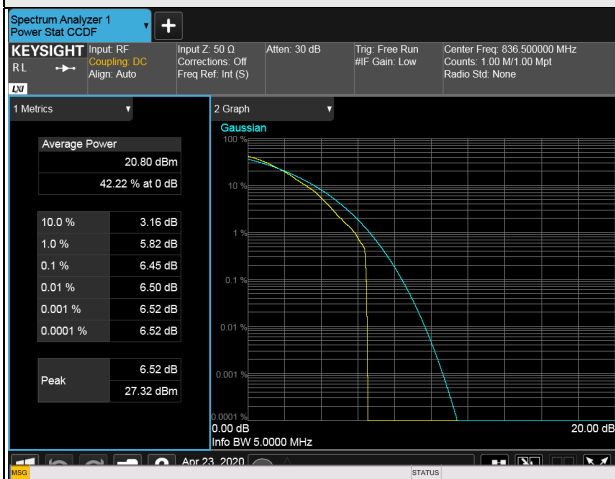
#### 1.4MHz / 64QAM



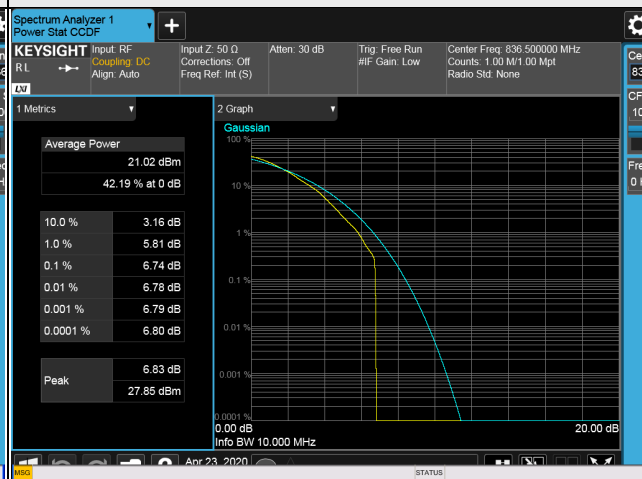
#### 3MHz / 64QAM



#### 5MHz / 64QAM



#### 10MHz / 64QAM

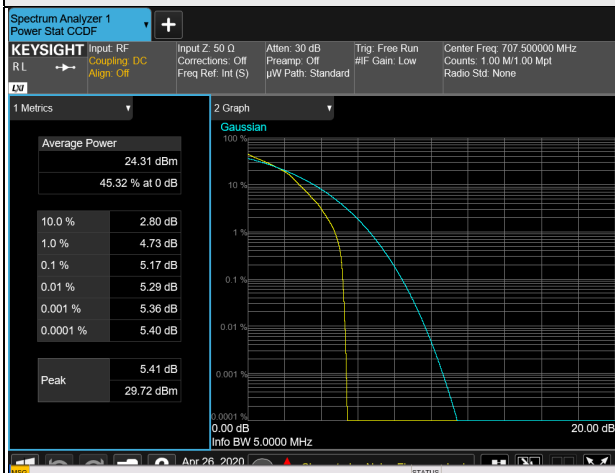


LTE Band 12

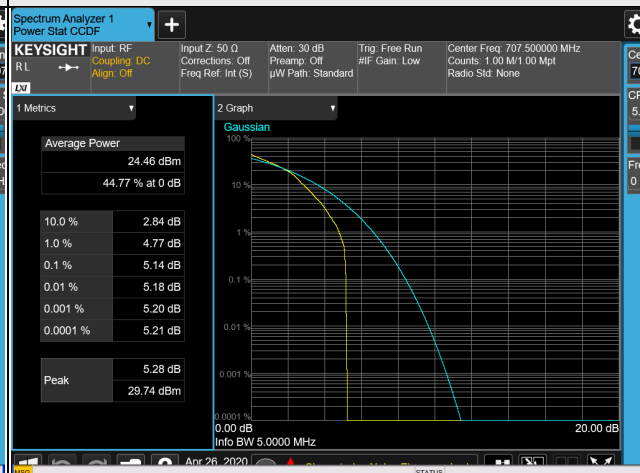
LTE Band 12, Channel Bandwidth 1.4MHz				
Channel	Frequency (MHz)	Peak To Average Ratio (dB)		
		QPSK	16QAM	64QAM
23017	699.7	3.72	4.51	4.50
23095	707.5	3.64	5.07	5.17
23173	715.3	3.61	4.41	4.51
LTE Band 12, Channel Bandwidth 3MHz				
Channel	Frequency (MHz)	Peak To Average Ratio (dB)		
		QPSK	16QAM	64QAM
23025	700.5	3.50	4.38	4.40
23095	707.5	3.47	5.05	5.14
23165	714.5	3.43	4.61	4.66
LTE Band 12, Channel Bandwidth 5MHz				
Channel	Frequency (MHz)	Peak To Average Ratio (dB)		
		QPSK	16QAM	64QAM
23035	701.5	3.51	4.34	4.51
23095	707.5	3.47	5.03	5.06
23155	713.5	3.51	5.02	5.10
LTE Band 12, Channel Bandwidth 10MHz				
Channel	Frequency (MHz)	Peak To Average Ratio (dB)		
		QPSK	16QAM	64QAM
23060	704.0	3.32	4.77	4.72
23095	707.5	3.27	4.77	4.80
23130	711.0	3.66	5.22	5.28

### Spectrum Plot of Worst Value

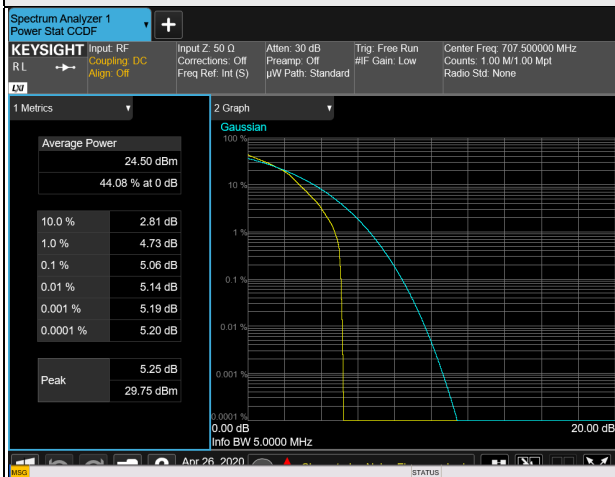
#### 1.4MHz / 64QAM



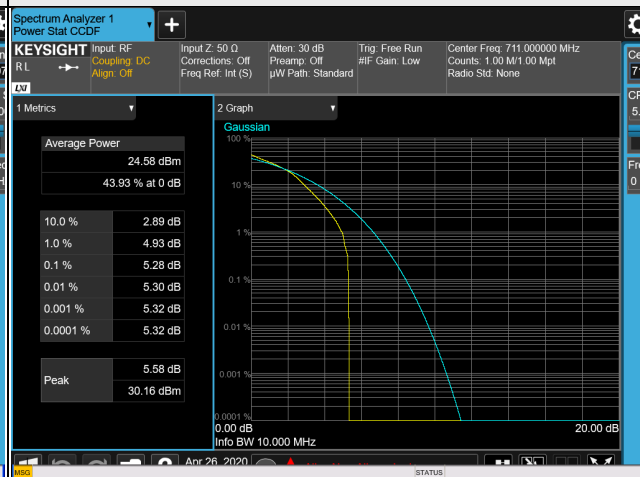
#### 3MHz / 64QAM



#### 5MHz / 64QAM



#### 10MHz / 64QAM

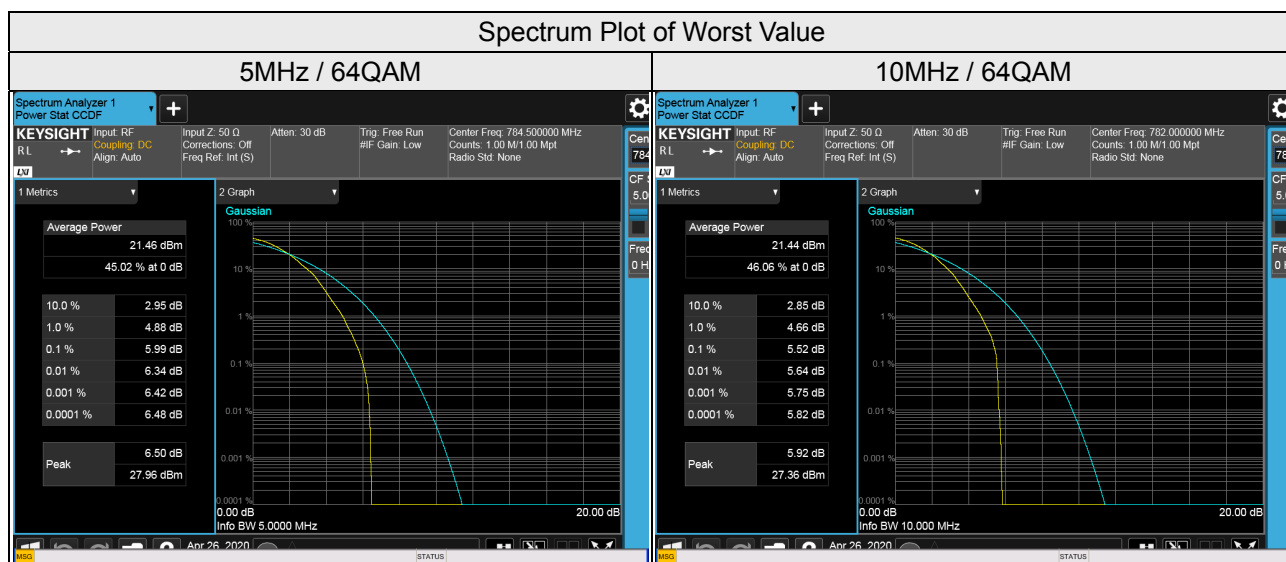


### LTE Band 13

LTE Band 13, Channel Bandwidth 5MHz				
Channel	Frequency (MHz)	Peak To Average Ratio (dB)		
		QPSK	16QAM	64QAM
23205	779.5	3.22	4.33	5.51
23230	782.0	3.06	4.31	5.75
23255	784.5	3.24	3.30	5.99

LTE Band 13, Channel Bandwidth 10MHz				
Channel	Frequency (MHz)	Peak To Average Ratio (dB)		
		QPSK	16QAM	64QAM
23230	782.0	2.63	4.45	5.52

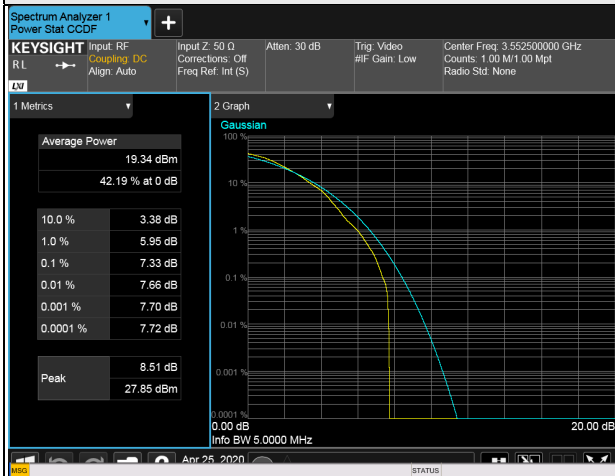


LTE Band 48

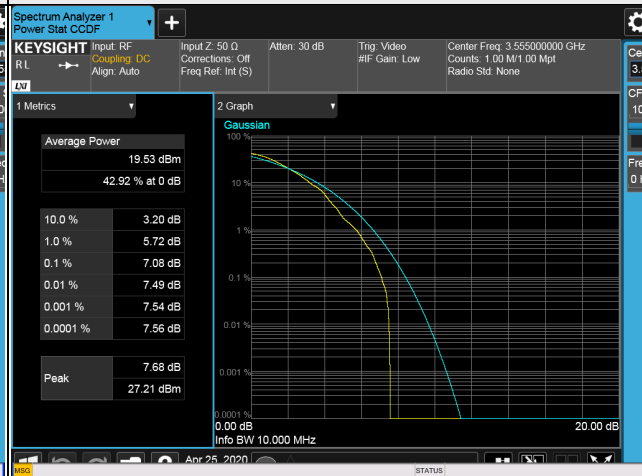
LTE Band 48, Channel Bandwidth 5MHz				
Channel	Frequency (MHz)	Peak To Average Ratio (dB)		
		QPSK	16QAM	64QAM
55265	3552.5	3.53	5.58	7.33
55990	3625.0	3.75	6.69	7.14
56715	3697.5	3.75	5.77	7.08
LTE Band 48, Channel Bandwidth 10MHz				
Channel	Frequency (MHz)	Peak To Average Ratio (dB)		
		QPSK	16QAM	64QAM
55290	3555.0	3.96	5.94	7.08
55990	3625.0	3.76	6.18	6.94
56690	3695.0	3.79	6.36	6.99
LTE Band 48, Channel Bandwidth 15MHz				
Channel	Frequency (MHz)	Peak To Average Ratio (dB)		
		QPSK	16QAM	64QAM
55315	3557.5	4.68	6.18	7.06
55990	3625.0	4.86	6.11	7.03
56665	3692.5	4.79	6.57	6.84
LTE Band 48, Channel Bandwidth 20MHz				
Channel	Frequency (MHz)	Peak To Average Ratio (dB)		
		QPSK	16QAM	64QAM
55340	3560.0	4.76	6.27	7.56
55990	3625.0	4.70	6.36	7.05
56640	3690.0	4.86	6.02	6.92

### Spectrum Plot of Worst Value

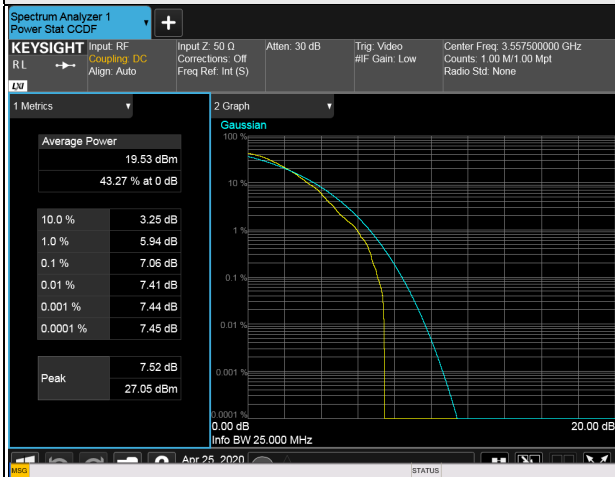
#### 5MHz / 64QAM



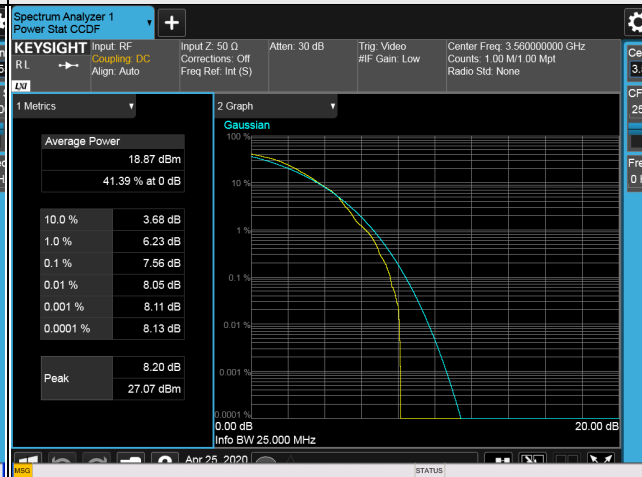
#### 10MHz / 64QAM



#### 15MHz / 64QAM



#### 20MHz / 64QAM



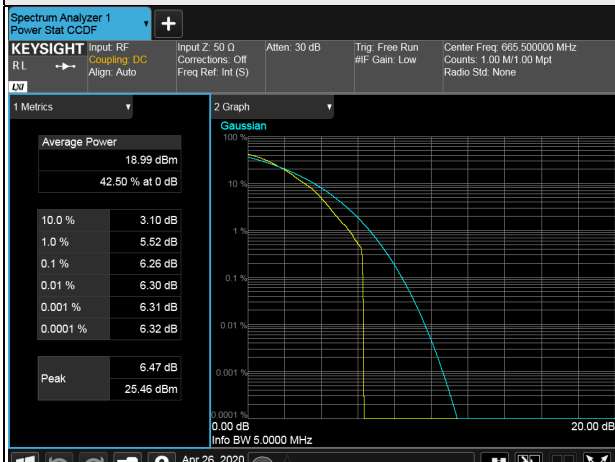
LTE Band 71

LTE Band 71, Channel Bandwidth 5MHz				
Channel	Frequency (MHz)	Peak To Average Ratio (dB)		
		QPSK	16QAM	64QAM
133147	665.5	3.52	4.21	6.26
133297	680.5	3.70	4.71	6.23
133447	695.5	3.72	5.02	6.22
LTE Band 71, Channel Bandwidth 10MHz				
Channel	Frequency (MHz)	Peak To Average Ratio (dB)		
		QPSK	16QAM	64QAM
133172	668	3.39	4.13	6.12
133297	680.5	3.82	5.08	6.27
133422	693	3.80	5.58	6.70
LTE Band 71, Channel Bandwidth 15MHz				
Channel	Frequency (MHz)	Peak To Average Ratio (dB)		
		QPSK	16QAM	64QAM
133197	670.5	3.36	4.12	6.04
133297	680.5	3.60	5.16	6.79
133397	690.5	3.57	4.37	6.26
LTE Band 71, Channel Bandwidth 20MHz				
Channel	Frequency (MHz)	Peak To Average Ratio (dB)		
		QPSK	16QAM	64QAM
133222	673	3.40	4.11	6.11
133297	680.5	3.67	4.41	6.38
133372	688	3.37	4.97	6.04

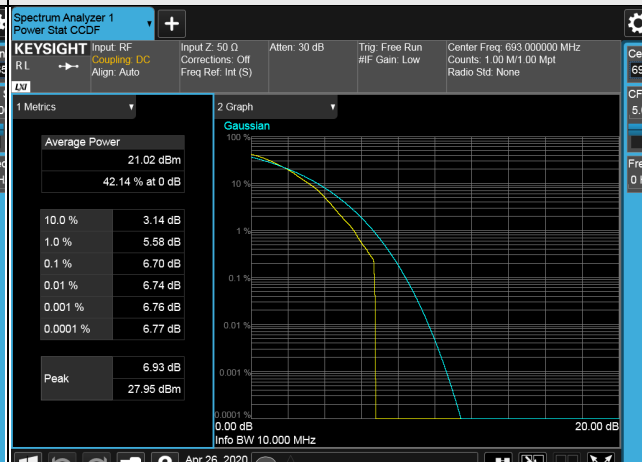


### Spectrum Plot of Worst Value

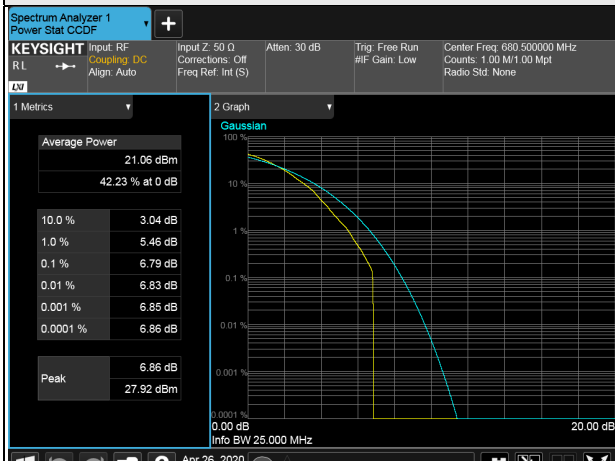
#### 5MHz / 64QAM



#### 10MHz / 64QAM



#### 15MHz / 64QAM



#### 20MHz / 64QAM



## 4.7 Conducted Spurious Emissions

### 4.7.1 Limits of Conducted Spurious Emissions Measurement

For n66

In the FCC 27.53(h), On any frequency outside a licensee's frequency block, The power of any emission shall be attenuated below the transmitter power (P) by at least  $43 + 10 \log(P)$  dB. The emission limit equal to  $-13\text{dBm}$ .

For LTE Band 5

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43 + 10 \log(P)$  dB. The emission limit equal to  $-13\text{dBm}$ .

For LTE Band 12, 71

According to FCC 27.53(g) for operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least  $43 + 10 \log(P)$  dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater.

For LTE Band 13

According to FCC 27.53(c)(2) for on any frequency outside the 776-788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least  $43 + 10 \log(P)$  dB.

According to FCC 27.53(f) for operations in the 775-788 MHz, emissions in the band 1559-1610 MHz shall be limited to  $-70$  dBW/MHz. The limit of emissions is equal to  $-40$  dBm

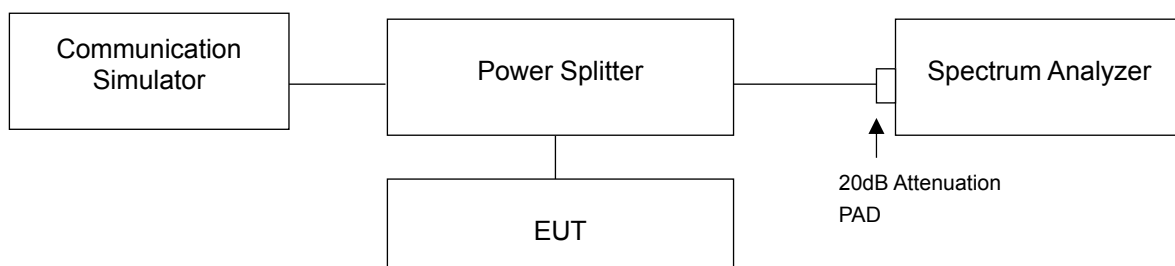
For LTE Band 30

In the FCC 27.53(a)(4)(iii), the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) by at least  $70 + 10 \log(P)$  dB. The limit of emission is equal to  $-40$  dBm.

For LTE Band 48

Power of any emissions outside the Fundamental	Limit
Within 0-10MHz above the Assigned Channel	-13 dBm/MHz
Within 0-10MHz below the Assigned Channel	
Greater than 0-10MHz above the Assigned Channel	-25 dBm/MHz
Greater than 0-10MHz below the Assigned Channel	
Power of any emission below 3530MHz	-40 dBm/MHz
Power of any emission above 3720MHz	

### 4.7.2 Test Setup



#### 4.7.3 Test Procedure

- a. The EUT makes a phone call to the communication simulator. All measurements were done at low, middle and high operational frequency range.
- b. Measuring frequency range is from 9kHz to 9GHz /10GHz. 20dB attenuation pad is connected with spectrum. RBW=1MHz and VBW=3MHz is used for conducted emission measurement.

For LTE Band 48

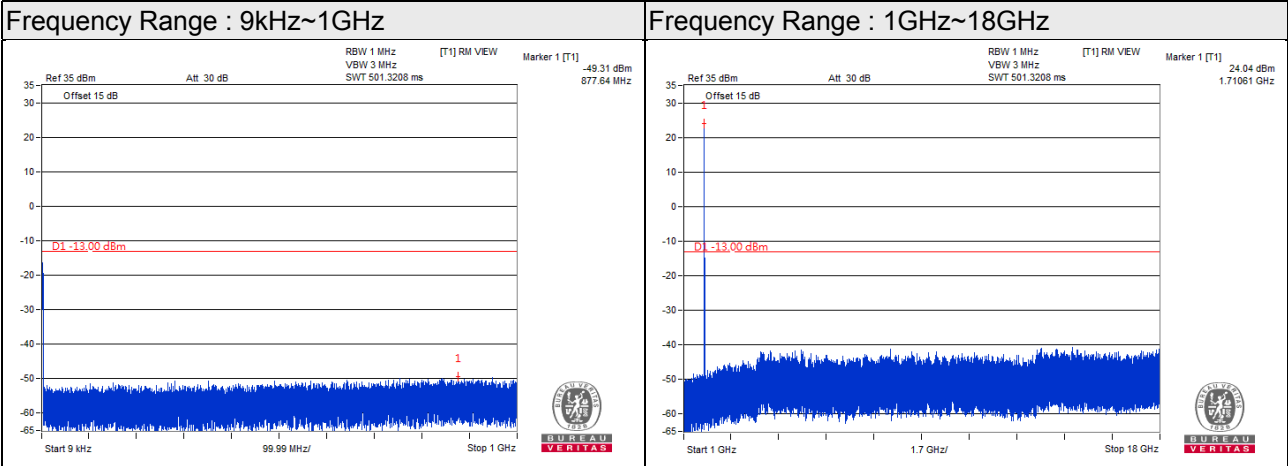
- a. The EUT makes a phone call to the communication simulator. All measurements were done at low, middle and high operational frequency range.
- b. Measuring frequency range is from 9 kHz to 37 GHz. 20dB attenuation pad is connected with spectrum. RBW=1MHz and VBW=3MHz is used for conducted emission measurement.
- c. Measuring frequency band edge, 20dB attenuation pad is connected with spectrum. 1% of the fundamental emission bandwidth is used for conducted emission measurement.
- d. For 5MHz channel BW mode, extend the 1% range from 1M to 2M above and below the channel edge and then reduce the limit further by  $10 \log(1000/51)=13\text{dB}$  (i.e. total  $-13 + -13=-26\text{dB}$ ) to compensate for the integration from 51k to 1M.

### 4.7.4 Test Results

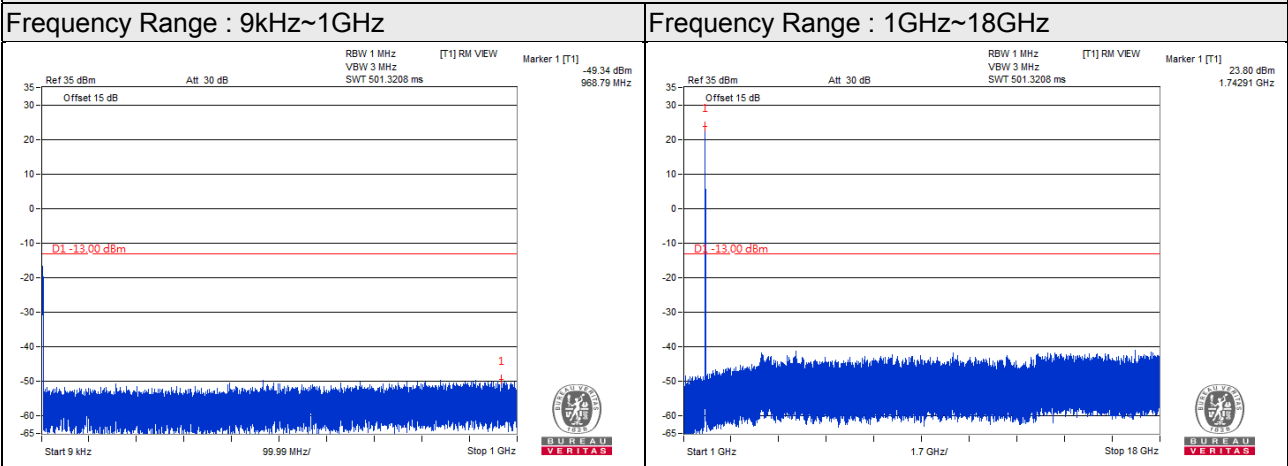
n66

Channel Bandwidth: 5MHz

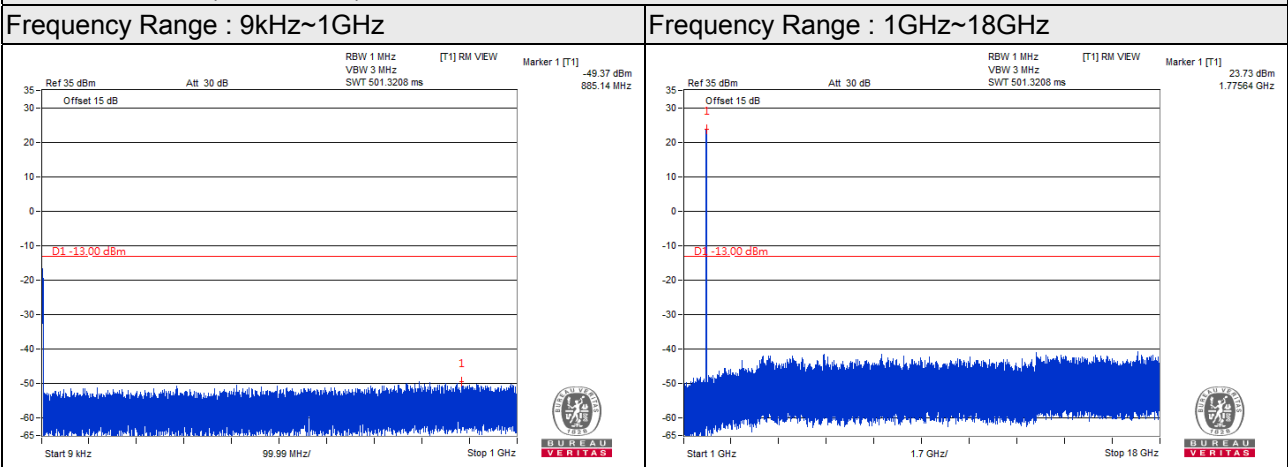
Channel 342500 (1712.5MHz)



Channel 349000 (1745.0MHz)



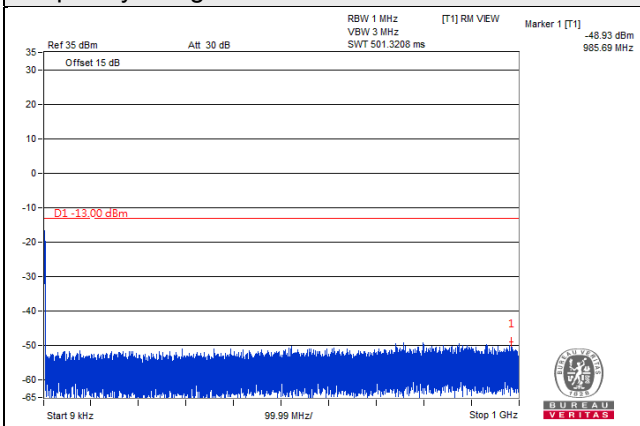
Channel 355500 (1777.5MHz)



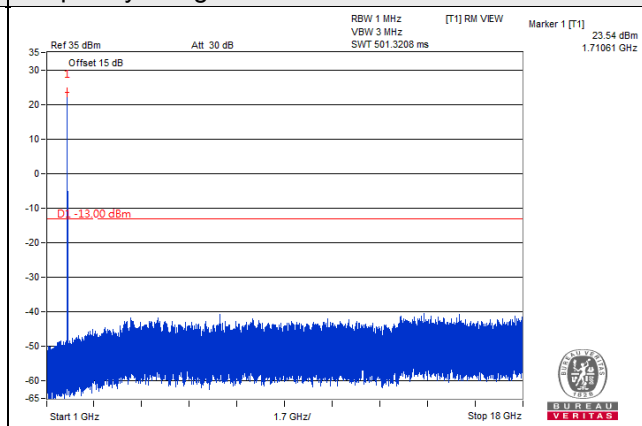
Channel Bandwidth: 10MHz

Channel 343000 (1715.0MHz)

Frequency Range : 9kHz~1GHz

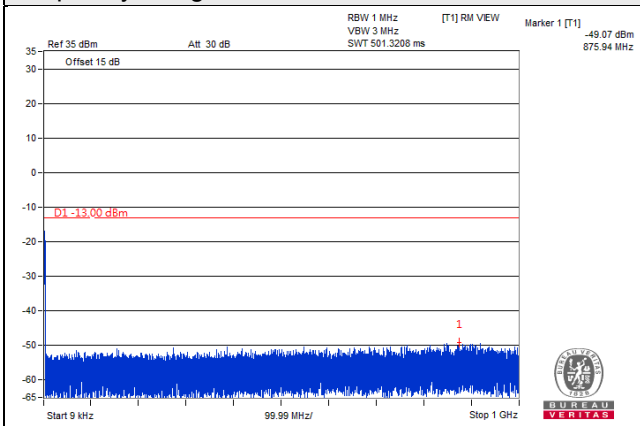


Frequency Range : 1GHz~18GHz

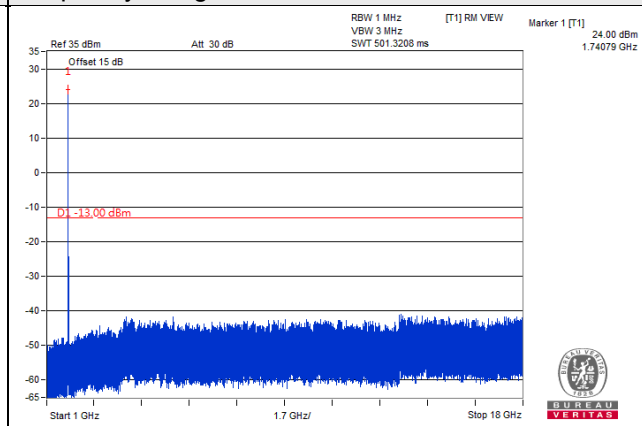


Channel 349000 (1745.0MHz)

Frequency Range : 9kHz~1GHz

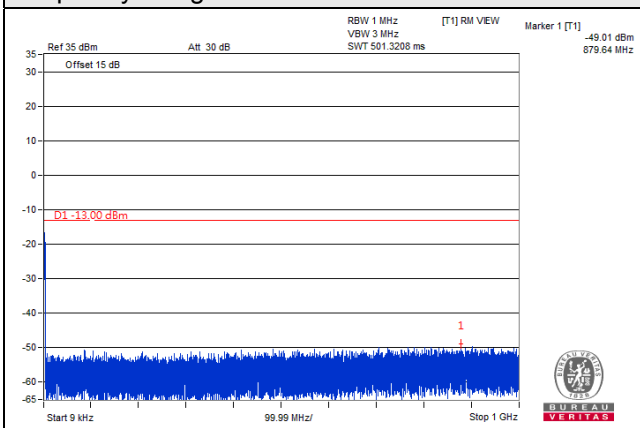


Frequency Range : 1GHz~18GHz

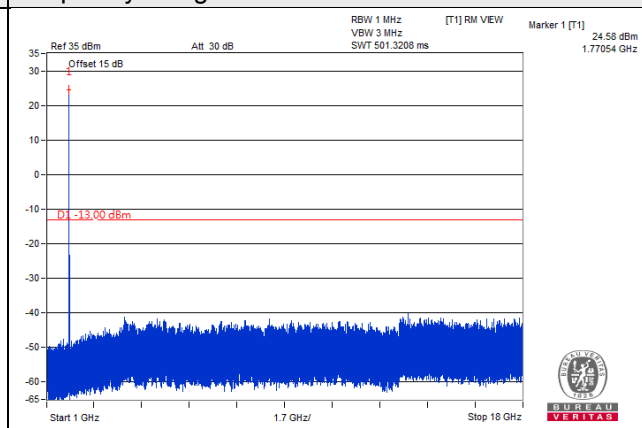


Channel 355000 (1775.0MHz)

Frequency Range : 9kHz~1GHz



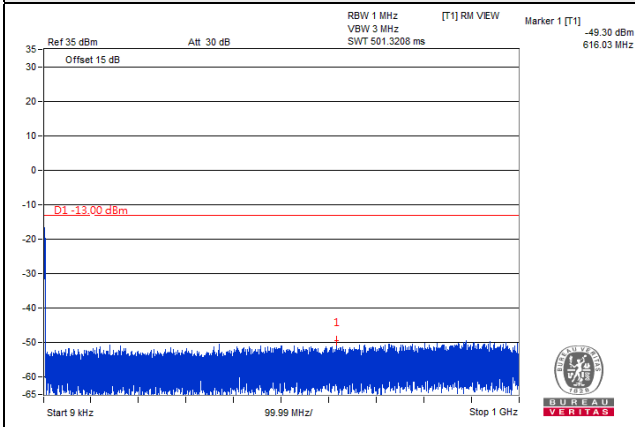
Frequency Range : 1GHz~18GHz



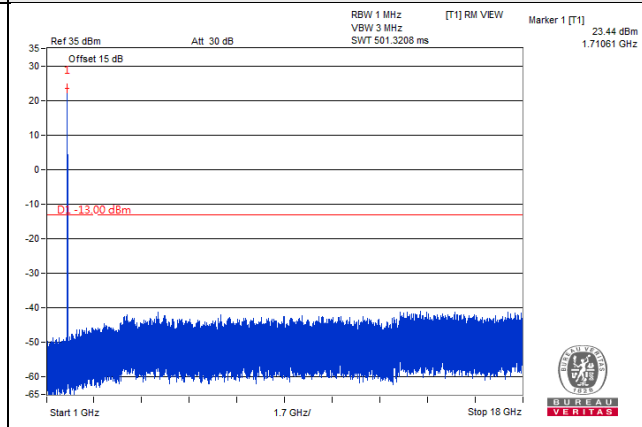
Channel Bandwidth: 15MHz

Channel 343500 (1717.5MHz)

Frequency Range : 9kHz~1GHz

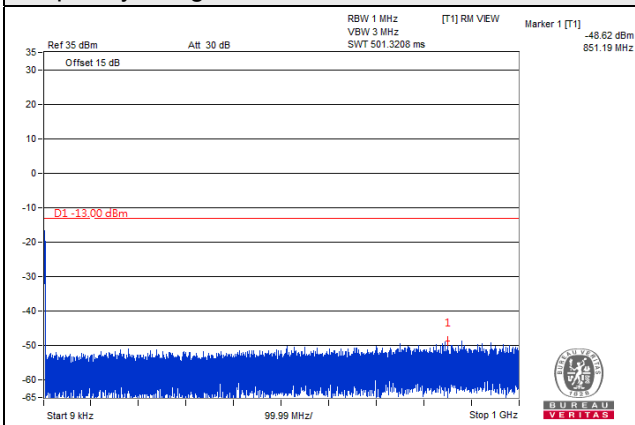


Frequency Range : 1GHz~18GHz

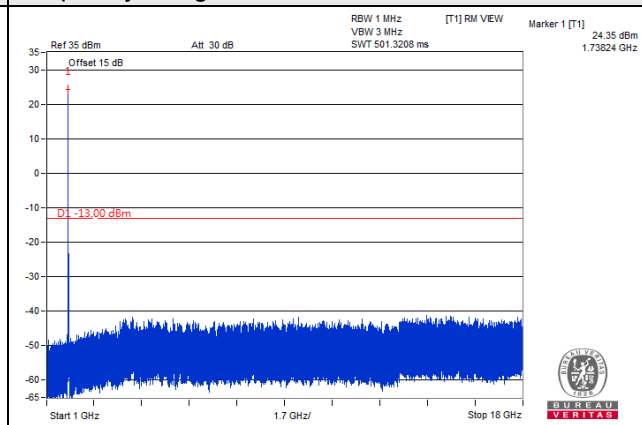


Channel 349000 (1745.0MHz)

Frequency Range : 9kHz~1GHz

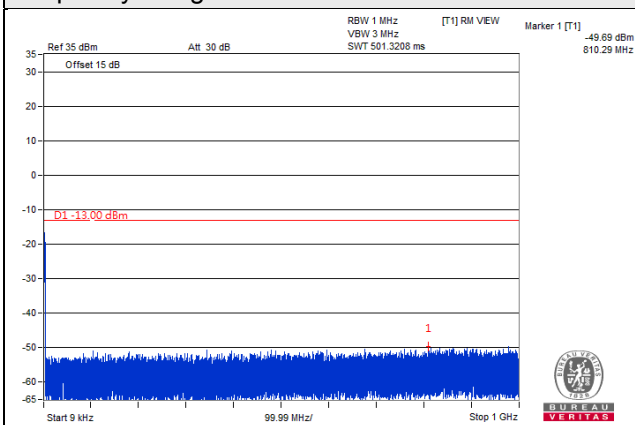


Frequency Range : 1GHz~18GHz

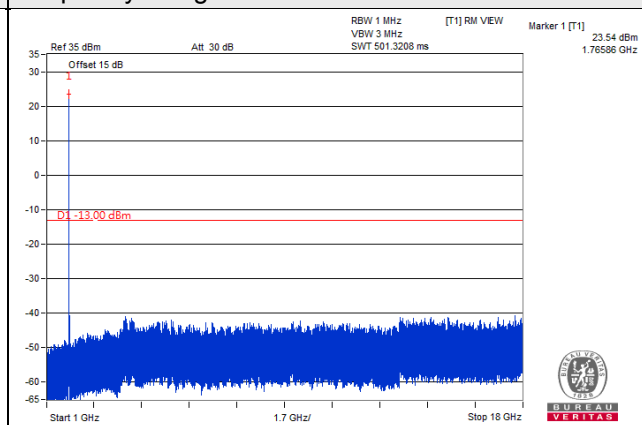


Channel 354500 (1772.5MHz)

Frequency Range : 9kHz~1GHz



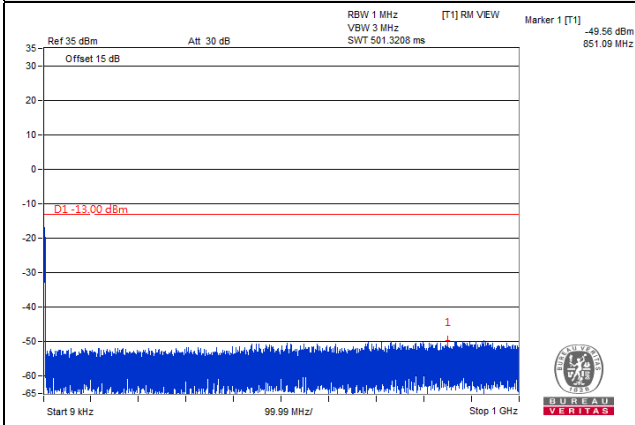
Frequency Range : 1GHz~18GHz



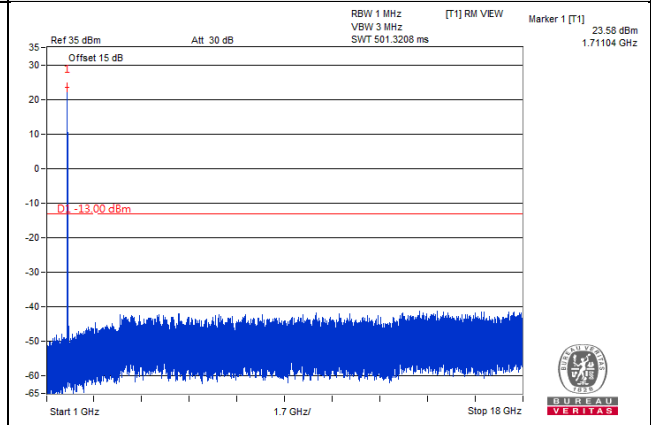
Channel Bandwidth: 20MHz

Channel 344000 (1720.0MHz)

Frequency Range : 9kHz~1GHz

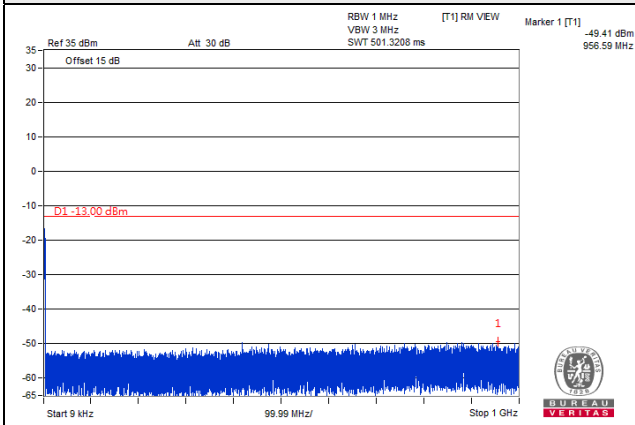


Frequency Range : 1GHz~18GHz

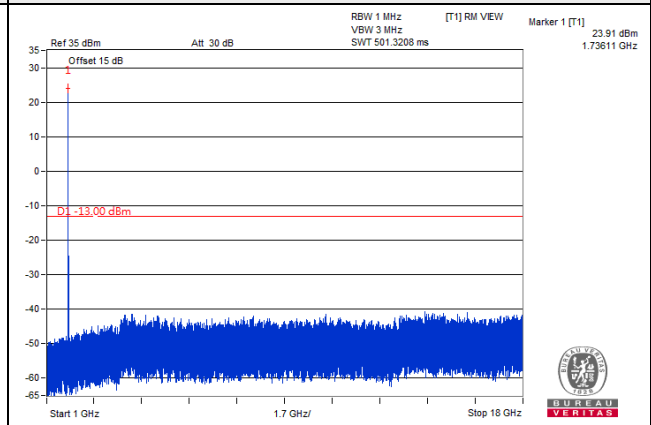


Channel 349000 (1745.0MHz)

Frequency Range : 9kHz~1GHz

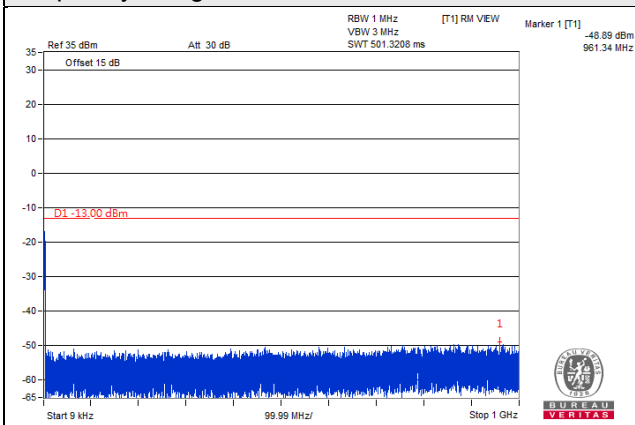


Frequency Range : 1GHz~18GHz

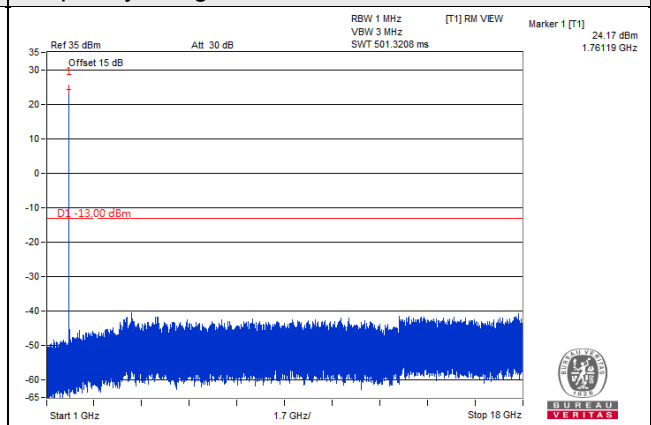


Channel 354000 (1770.0MHz)

Frequency Range : 9kHz~1GHz



Frequency Range : 1GHz~18GHz

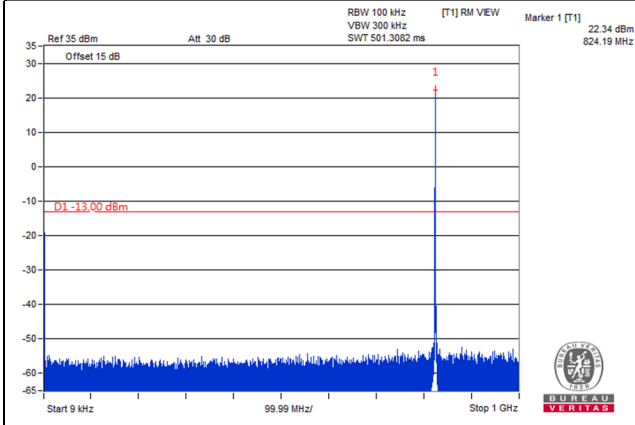


LTE Band 5

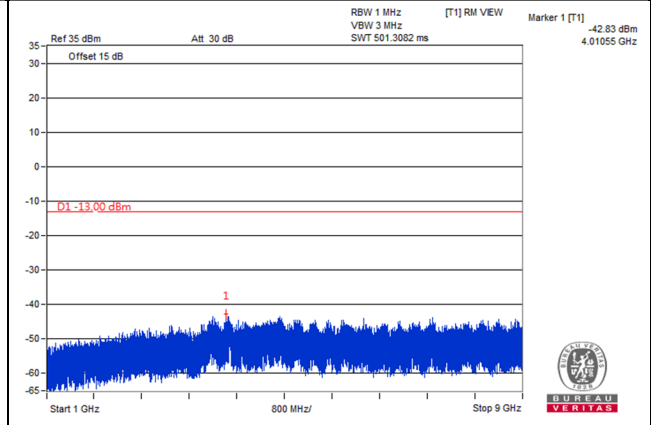
Channel Bandwidth 1.4MHz

Channel 20407 (824.7MHz)

Frequency Range : 9kHz~1GHz

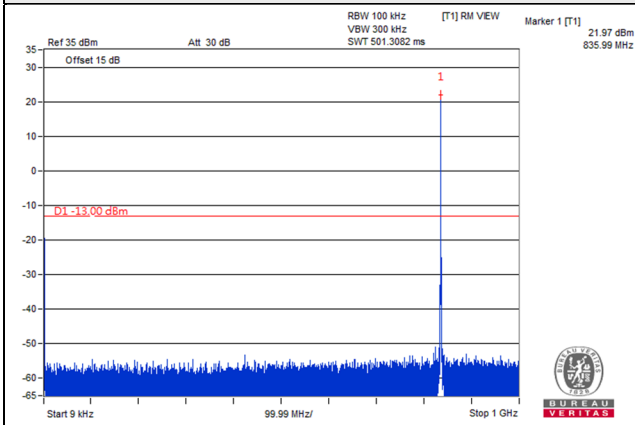


Frequency Range : 1GHz~9GHz

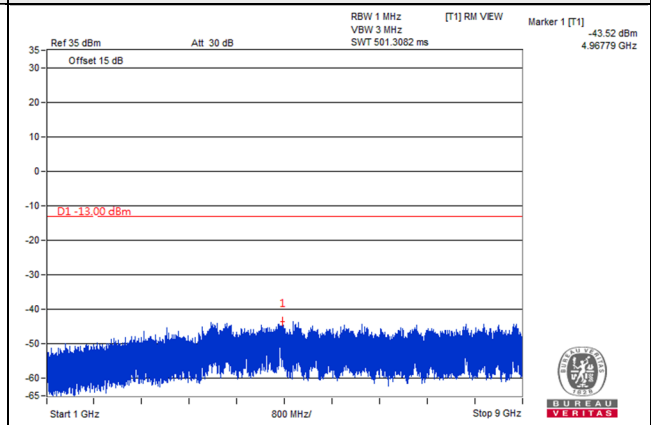


Channel 20525 (836.5MHz)

Frequency Range : 9kHz~1GHz

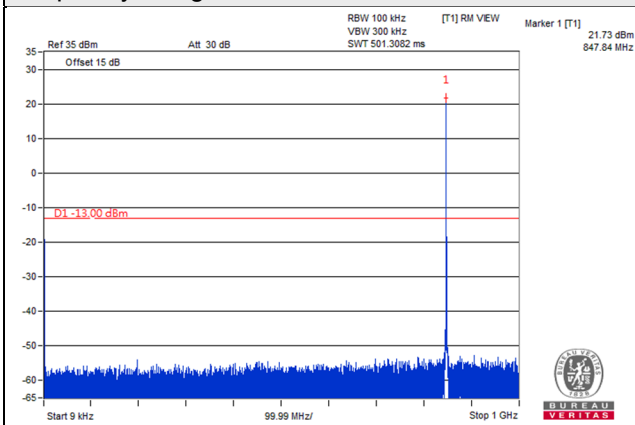


Frequency Range : 1GHz~9GHz

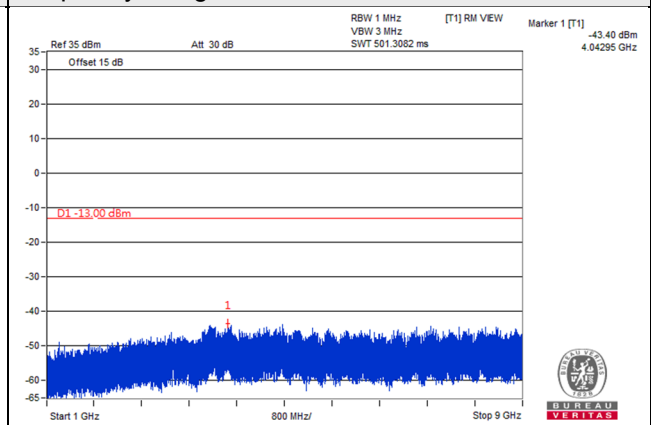


Channel 20643 (848.3MHz)

Frequency Range : 9kHz~1GHz



Frequency Range : 1GHz~9GHz



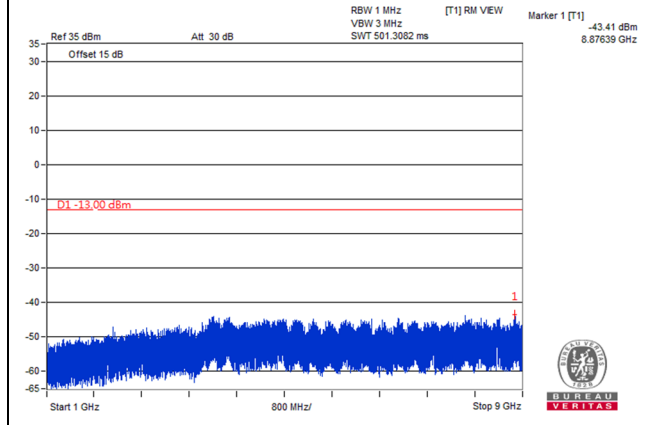
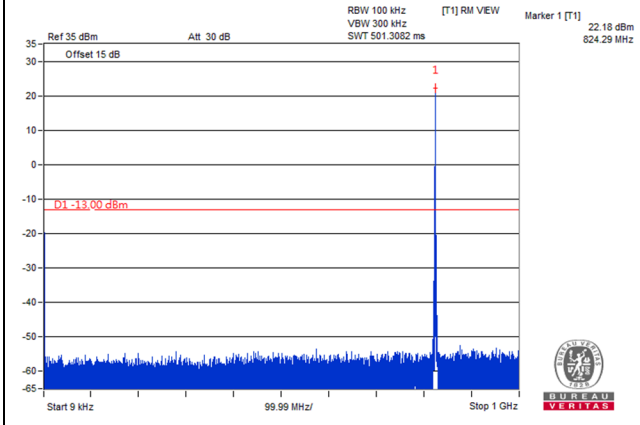
\*The 9kHz signal over the limit is from Spectrum.



**Channel Bandwidth 3MHz**

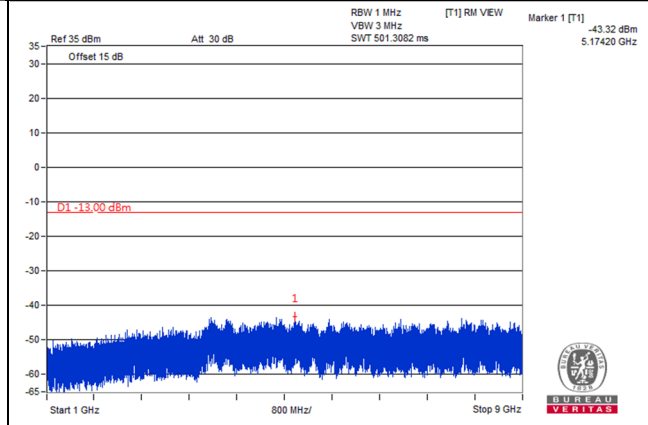
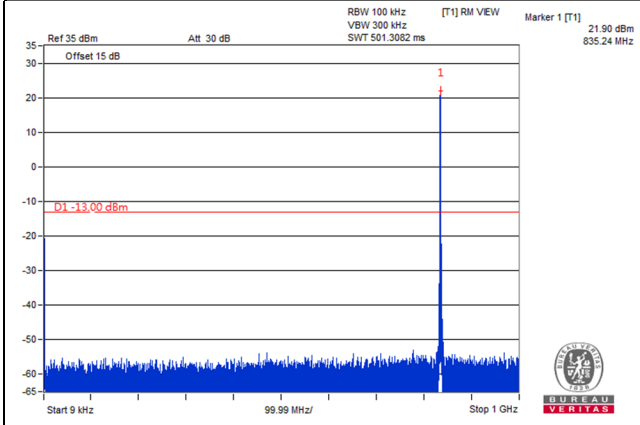
**Channel 20415 (825.5MHz)**

**Frequency Range : 9kHz~1GHz**      **Frequency Range : 1GHz~9GHz**



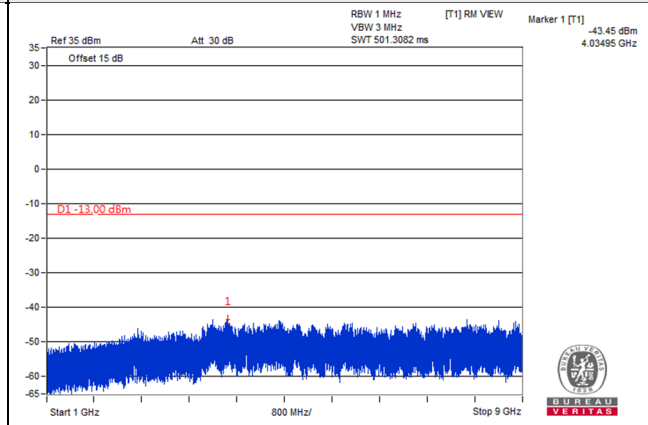
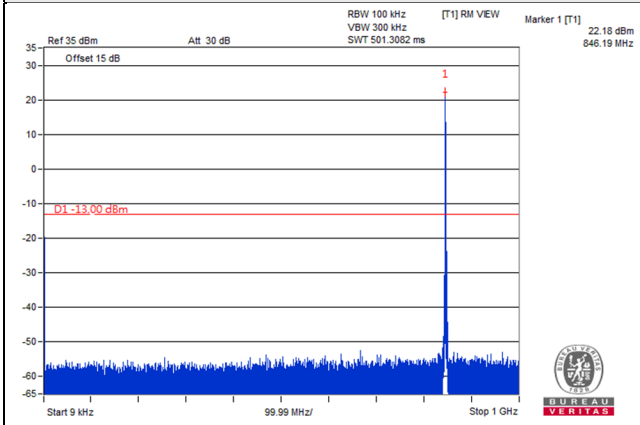
**Channel 20525 (836.5MHz)**

**Frequency Range : 9kHz~1GHz**      **Frequency Range : 1GHz~9GHz**



**Channel 20635 (847.5MHz)**

**Frequency Range : 9kHz~1GHz**      **Frequency Range : 1GHz~9GHz**

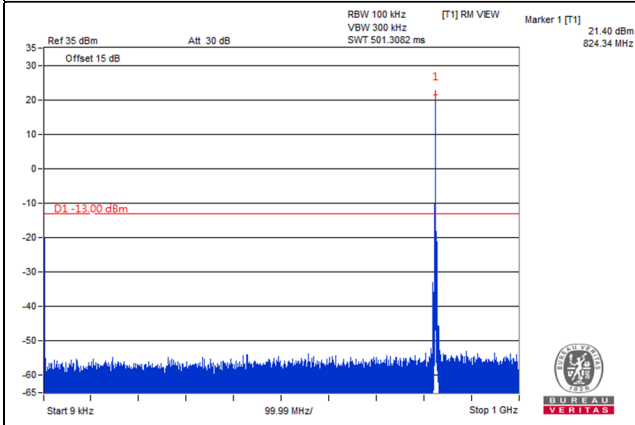


\*The 9kHz signal over the limit is from Spectrum.

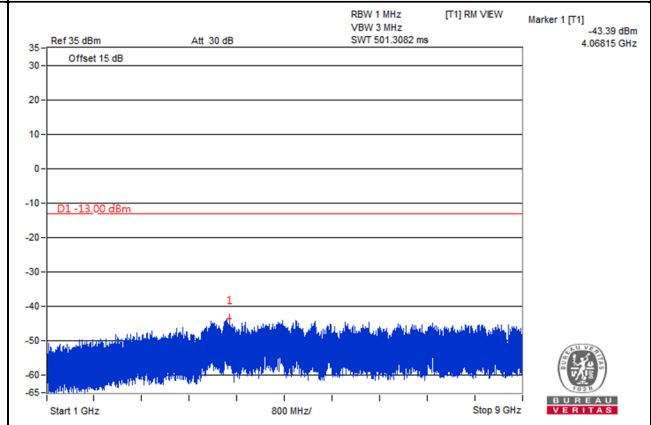
Channel Bandwidth 5MHz

Channel 20425 (826.5MHz)

Frequency Range : 9kHz~1GHz

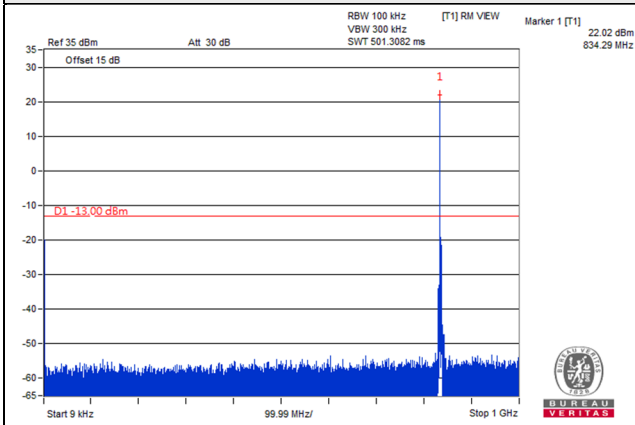


Frequency Range : 1GHz~9GHz

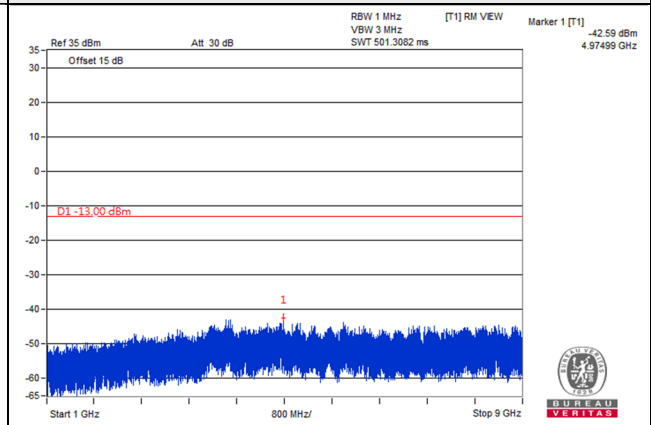


Channel 20525 (836.5MHz)

Frequency Range : 9kHz~1GHz

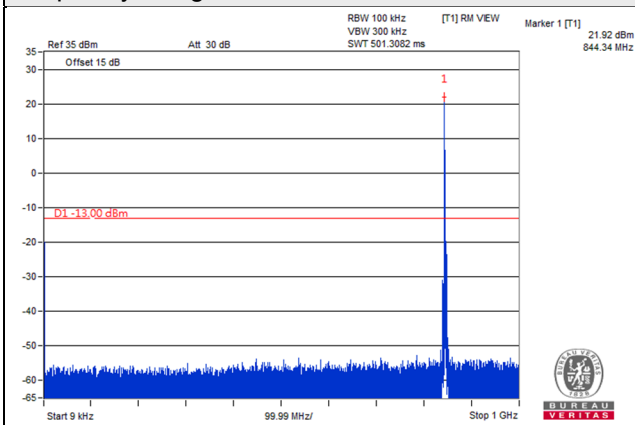


Frequency Range : 1GHz~9GHz

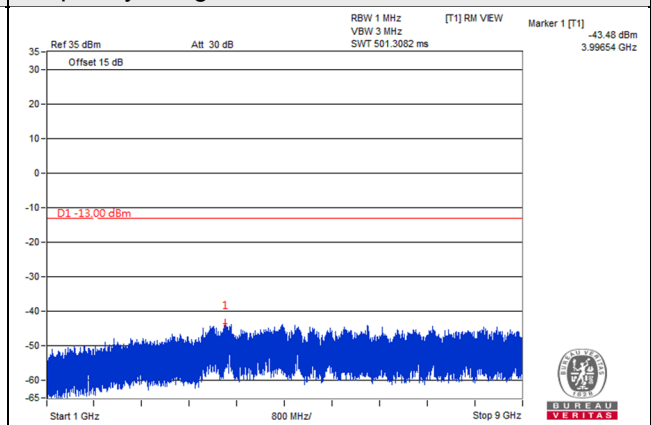


Channel 20625 (846.5MHz)

Frequency Range : 9kHz~1GHz



Frequency Range : 1GHz~9GHz

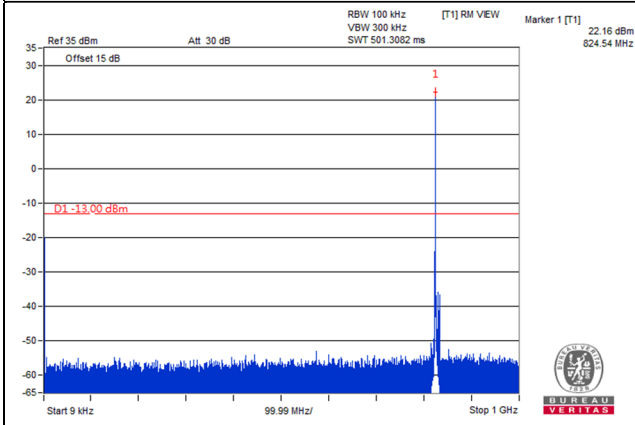


\*The 9kHz signal over the limit is from Spectrum.

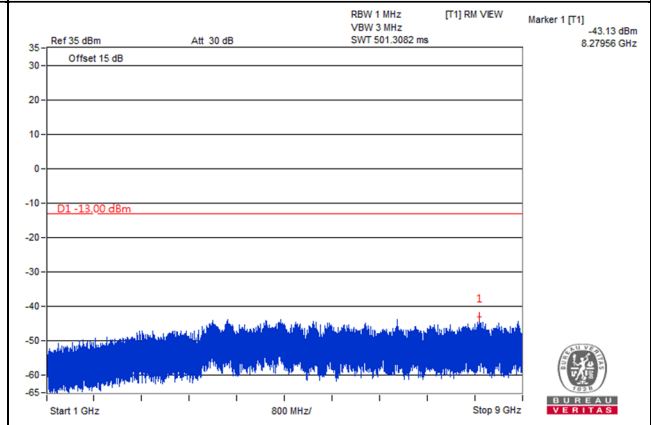
Channel Bandwidth 10MHz

Channel 20450 (829.0MHz)

Frequency Range : 9kHz~1GHz

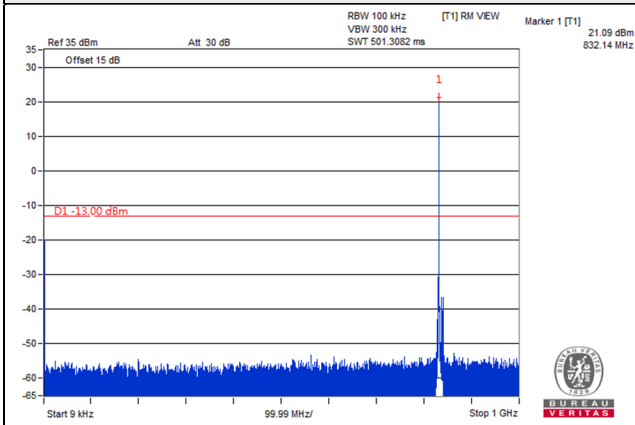


Frequency Range : 1GHz~9GHz

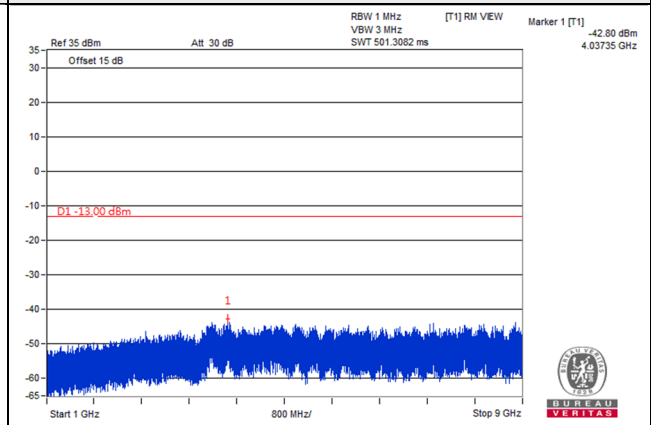


Channel 20525 (836.5MHz)

Frequency Range : 9kHz~1GHz

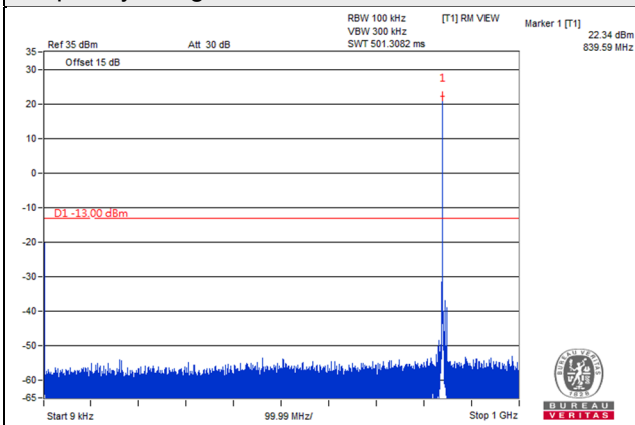


Frequency Range : 1GHz~9GHz

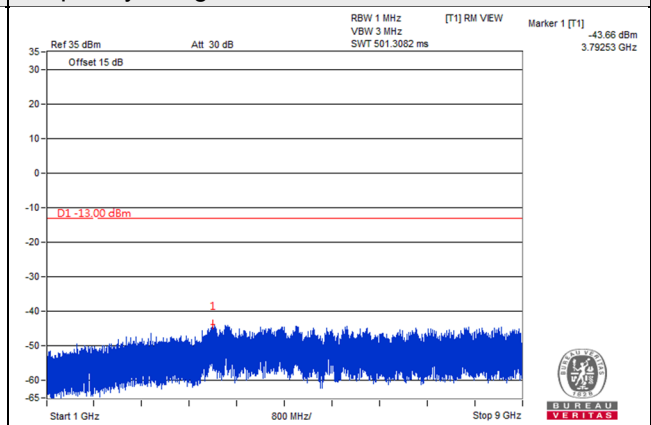


Channel 20600 (844.0MHz)

Frequency Range : 9kHz~1GHz



Frequency Range : 1GHz~9GHz



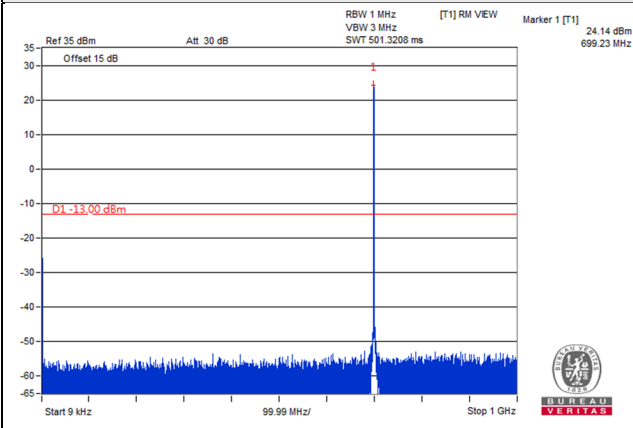
\*The 9kHz signal over the limit is from Spectrum.

LTE Band 12

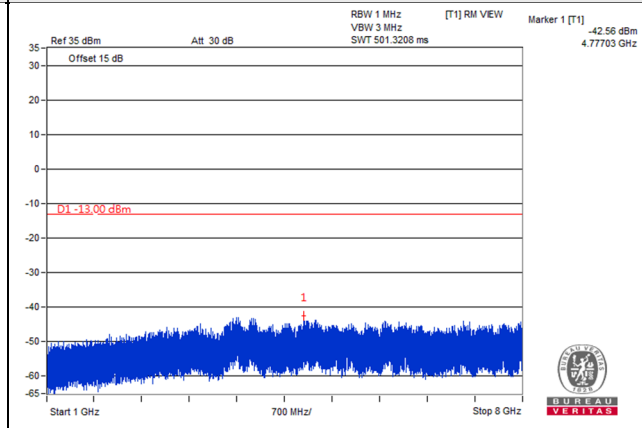
Channel Band width: 1.4MHz

Channel 23017 (699.7MHz)

Frequency Range : 9kHz~1GHz

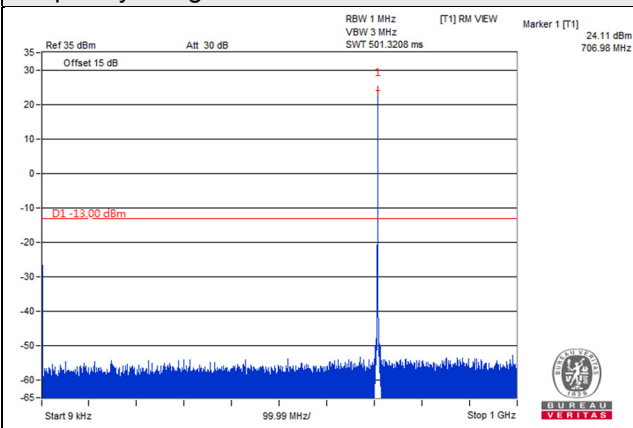


Frequency Range : 1GHz~8GHz

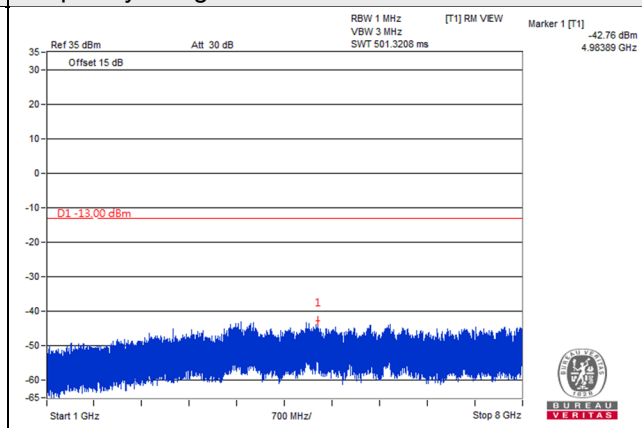


Channel 23095 (707.5MHz)

Frequency Range : 9kHz~1GHz

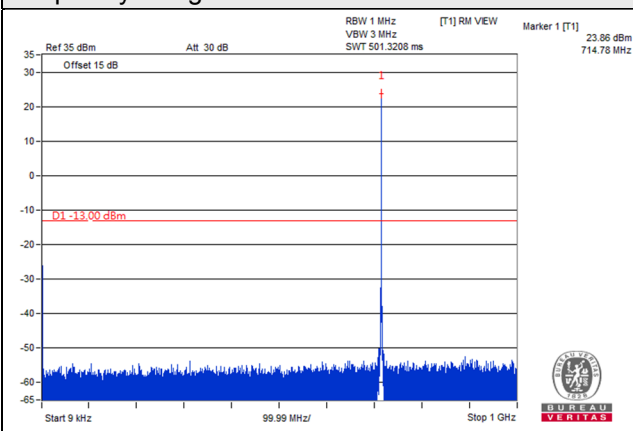


Frequency Range : 1GHz~8GHz



Channel 23173 (715.3MHz)

Frequency Range : 9kHz~1GHz



Frequency Range : 1GHz~8GHz

